IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	Mark Franklin Davis		
Serial No.:	10/522,515	Examiner:	Jason Kurr
Filing Date:	January 27, 2005	Art Unit:	2644
Title:	Audio Channel Spatial Translation		
Conf. No.	1657		

February 18, 2009
San Francisco, California

Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

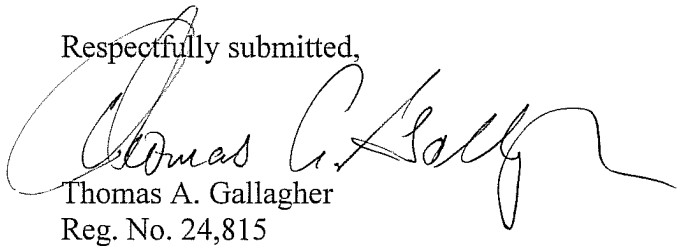
SUMMARY OF TELEPHONIC INTERVIEWS

On Thursday, February 12th, Examiner Jason Kurr telephoned and spoke with the undersigned attorney's assistant, Anne O'Shea, proposing to insert by Examiner's Amendment "the matrix is implemented by a digital signal processor" in line 4 of claim 1 and, similarly, in claim 36.

On Friday, February 13th, the undersigned attorney, being out of town, telephoned Examiner Kurr and asked if he could respond to the him the coming week. It was so agreed.

Today, Wednesday, February 18, 2009, the undersigned attorney spoke with Examiner Kurr, agreeing with the proposed insertions in process claims 1 and 36. The undersigned attorney proposed the addition of two new independent claims in the form of "means plus function claims," the functions of which paralleled the process claims 1 and 36. The undersigned faxed amended claims 1 and 36 along with proposed new claims 37 and 38 (as shown in the attached pages) to the Examiner. In a subsequent telephone call this same day, the Examiner agreed to the amendments and to the new means plus function claims.

Respectfully submitted,



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For discussion purposes

As we just agreed with respect to claims 1 and 36:

1. A process for translating M audio input signals, each associated with a direction, to N audio output signals, each associated with a direction, wherein N is larger than M, M is two or more and N is a positive integer equal to three or more, comprising

providing an M:N variable matrix, wherein the matrix is implemented by a digital signal processor,

applying said M audio input signals to said variable matrix,

deriving said N audio output signals from said variable matrix, and

controlling said variable matrix in response to measures of (1) the relative levels of said input signals, and (2) the cross-correlation of said input signals so that a soundfield generated by said output signals has a compact sound image in the nominal ongoing primary direction of the input signals when the input signals are highly correlated, the image spreading from compact to broad as the correlation decreases and progressively splitting into multiple compact sound images, each in a direction associated with an input signal, as the correlation continues to decrease to highly uncorrelated,

wherein for a measure of cross-correlation of the input signals having values in a first range, bounded by a maximum value and a reference value, the soundfield has a compact sound image when the measure of cross-correlation is said maximum value and has a broadly spread image when the measure of cross-correlation is said reference value, and for a measure of cross-correlation of the input signals having values in a second range, bounded by said reference value and a minimum value, the soundfield has said broadly spread image when the measure of cross-correlation is said reference value and has a plurality of compact sound images, each in a direction associated with an input signal, when the measure of cross correlation is said minimum value.

36. A process for translating M audio input signals, each associated with a direction, to N audio output signals, each associated with a direction, wherein N is larger than M, M is two or more and N is a positive integer equal to three or more, comprising

providing an M:N variable matrix, wherein the matrix is implemented by a digital signal processor,

applying said M audio input signals to said variable matrix,

deriving said N audio output signals from said variable matrix, and

controlling said variable matrix in response to measures of (1) the relative levels of said input signals, and (2) the cross-correlation of said input signals so that a soundfield generated by said output signals has a compact sound image in the nominal ongoing primary direction of the input signals when the input signals are highly correlated, the image spreading from compact to broad as the correlation decreases and progressively splitting into multiple compact sound images, each in a direction associated with an input signal, as the correlation continues to decrease to highly uncorrelated,

wherein a first measure of the cross-correlation of the input signals is in response to a smoothed common energy of the input signals divided by the M^{th} root of the product of the smoothed energy level of each input signal, where M is the number of inputs, and

wherein an additional measure of cross-correlation is obtained by applying a measure of the relative levels of the input signals to said first measure of cross-correlation to produce a direction-weighted measure of cross-correlation, and

wherein yet an additional measure of cross-correlation of the inputs signals is obtained by applying a scaling factor about equal to a value of a measure of cross-correlation of the input signals for the case of equal energy in each of the outputs.

Proposed new means+function claims that track claims 1 and 36 as before the insertions above:

~~1~~37. ~~A process~~Apparatus for translating M audio input signals, each associated with a direction, to N audio output signals, each associated with a direction, wherein N is larger than M, M is two or more and N is a positive integer equal to three or more, comprising

means for providing an M:N variable matrix,

means for applying said M audio input signals to said variable matrix,

means for deriving said N audio output signals from said variable matrix, and

means for controlling said variable matrix in response to measures of (1) the relative levels of said input signals, and (2) the cross-correlation of said input signals so that a soundfield generated by said output signals has a compact sound image in the nominal ongoing primary direction of the input signals when the input signals are highly correlated, the image spreading from compact to broad as the correlation decreases and progressively splitting into multiple compact sound images, each in a direction associated with an input signal, as the correlation continues to decrease to highly uncorrelated,

wherein for a measure of cross-correlation of the input signals having values in a first range, bounded by a maximum value and a reference value, the soundfield has a compact sound image when the measure of cross-correlation is said maximum value and has a broadly spread image when the measure of cross-correlation is said reference value, and for a measure of cross-correlation of the input signals having values in a second range, bounded by said reference value and a minimum value, the soundfield has said broadly spread image when the measure of cross-correlation is said reference value and has a plurality of compact sound images, each in a direction associated with an input signal, when the measure of cross correlation is said minimum value.

~~36~~38. ~~A process~~Apparatus for translating M audio input signals, each associated with a direction, to N audio output signals, each associated with a direction, wherein N is larger than M, M is two or more and N is a positive integer equal to three or more, comprising

means for providing an M:N variable matrix,

means for applying said M audio input signals to said variable matrix,

means for deriving said N audio output signals from said variable matrix, and

means for controlling said variable matrix in response to measures of (1) the relative levels of said input signals, and (2) the cross-correlation of said input signals so that a soundfield generated by said output signals has a compact sound image in the nominal ongoing primary direction of the input signals when the input signals are highly correlated, the image spreading from compact to broad as the correlation decreases and progressively splitting into multiple compact sound images, each in a direction associated with an input signal, as the correlation continues to decrease to highly uncorrelated,

wherein a first measure of the cross-correlation of the input signals is ~~in response~~obtained by means responding to a smoothed common energy of the input signals divided by the M^{th} root of the product of the smoothed energy level of each input signal, where M is the number of inputs, and

wherein an additional measure of cross-correlation is obtained by means for applying a measure of the relative levels of the input signals to said first measure of cross-correlation to produce a direction-weighted measure of cross-correlation, and

wherein yet an additional measure of cross-correlation of the inputs signals is obtained by means for applying a scaling factor about equal to a value of a measure of cross-correlation of the input signals for the case of equal energy in each of the outputs.

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